REMARKS

The Office Action mailed March 27, 2009 (hereinafter referred to as "the Office Action") and the Advisory Action mailed June 25, 2009 (hereinafter referred to as "the Advisory Action") have been carefully reviewed and the following remarks have been made in consequence thereof.

Claims 1, 4-6, 8-11, 13-17, 19, and 21-24 are now pending in this application. Claims 1, 4-11, 13-17, 19, and 21-24 stand rejected. Claim 7 has been canceled herein.

Preliminarily, Page 5 of the Office Action admits that "Kanebako does not describe automatic determination of the long axis" and asserts that "Devito teaches a method for automatically identifying the long axis of the left ventricle." However, "[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." MPEP § 2143.01(VI). In that regard, Kanebako teaches that "[t]he long axis is set by . . . **moving the cursor on the screen of the image display device by using a mouse, a track ball, or the like**...." (Column 10, Lines 26-32) (emphasis added) (reference numerals omitted). As such, replacing the manual designation of the long axis in Kanebako with an automatic generation of an axis, as suggested in the Office Action, would "change the principle operation" of Kanebako, which is prohibited under Section 2143.01(VI) of the MPEP.

Furthermore, Kanebako and Devito are submitted to teach away from the combination asserted in the Office Action. As explained by the Federal Circuit, a reference teaches away "when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led a direction divergent from the path that was taken by the applicant." In re Gurley, 27 F.3d 551, 553 (Fed. Cir. 1994). In this instance, Kanebako teaches manual designation of the long axis. (Column 10, Lines 26-32). Clearly, the teachings of Kanebako would discourage one of ordinary skill in the art from automatically generating an axis, as suggested in the Office Action, considering that Devito explicitly teaches generating an axis "**without the need for input by the technician**." (Column 4, Lines 29-32) (emphasis added). As such, it is impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of

ordinary skill in the art (see MPEP § 2141.02(VI)). Therefore, Applicants submit that the Office cannot ignore the portions of Kanebako and Devito that teach away from the proposed combination.

For at least the reasons set forth above, the Claims are submitted to be patentable over Kanebako and Devito.

Furthermore, Page 2 of the Advisory Action states that, in Sheehan, "[i]t would be obvious to only include the important anatomical features required for a diagnosis in the images, which in certain circumstances would exclude papilary [sic] muscles." However, as stated above, "[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." MPEP § 2143.01(VI). In that regard, Sheehan enumerates particular anatomical structures or "landmarks" that are utilized to determine cardiac wall thickness and motion, and "[t]hese anatomic structures include papillary muscles." (Column 7, Lines 24-30; see also Column 16, Lines 29-37). As such, removing the papillary muscles in Sheehan, as suggested in the Office Action, would eliminate landmark reference points upon which Sheehan relies, thereby changing "the principle operation" of Sheehan which is prohibited under Section 2143.01(VI) of the MPEP.

Furthermore, Sheehan is submitted to teach away from the combination asserted in the Office Action. As stated above, a reference teaches away "when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led a direction divergent from the path that was taken by the applicant." In re Gurley, 27 F.3d 551, 553 (Fed. Cir. 1994). In this instance, Sheehan teaches utilizing the papillary muscles as landmarks to facilitate determining cardiac wall thickness and motion. (Column 7, Lines 24-30; Column 16, Lines 29-37). Clearly, the teachings of Sheehan would discourage one of ordinary skill in the art from removing the papillary muscles (i.e., removing the landmarks) from the images, as suggested in the Office Action. Again, it is impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art (see MPEP § 2141.02(VI)). Therefore, Applicants submit that the Office cannot ignore the portions of Sheehan that teach away from the proposed combination.

For at least the reasons set forth above, the Claims are submitted to be patentable over Sheehan.

Moreover, The rejection of Claims 1, 4-8, 10, 11, 13-17, 19, and 21-24 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,680,471 to Kanebako et al. (hereinafter referred to as "Kanebako") in view of U.S. Pat. No. 5,421,331 to Devito et al. (hereinafter referred to as "Devito") is respectfully traversed.

Kanebako describes an X-ray diagnosing apparatus including an X-ray tube (1), a detector (2), a data processing system (3), an image display device (4), an input unit (5), and an analyzer (6). X-ray tube (1) radiates X-rays onto an object (P), such as a patient, and detector (2) detects the X-rays transmitted through object (P) and converts the transmitted X-rays into an image signal. Data processing system (3) has an outline extractor (3c), i.e., a computer, and analyzer (6) receives the extracted data from the outline extractor (3c) and performs functional analysis of the left ventricle of the heart, such as, ejection fraction measurement based on the volume of the ventricle at the end of diastole and the volume of the ventricle at the end of systole, and a cardiac wall motion analysis. Outline extractor (3c) sets a long axis (LA) of the heart by designating two points, i.e., the middle point of the aortic valve and the apex portion of the heart, or three points, i.e., two end points of the aortic valve and the apex portion of the heart, upon moving the cursor on the screen of image display device (4) by using a mouse, a track ball, or the like (not shown). For example, long axis (LA) is set by connecting the middle point of the aortic valve to the apex portion of the heart via a line, and long axis profiles are generated by drawing a large number of perpendicular lines (VS) with respect to long axis (LA) at almost equal intervals, and obtaining the pixel values on respective perpendicular lines (VS). After the long axis perpendicular profiles are generated, outline points (OLP) of the left ventricle are sequentially determined, from the apex point of the heart to the middle point of the aortic valve, on the long axis perpendicular profiles, thereby extracting an outline (OL). A threshold value for detecting an outline point (OLP) is determined. The threshold value is obtained by the weighted mean of the inner densities and the densities of the background area, and, when outline point extraction with respect to all of the long axis perpendicular profiles is completed, the outline points of the adjacent profiles are connected to each other. The resultant outline data is output as a left ventricle outline. Notably, Kanebako does not describe nor suggest generating an

endocardial volume of a left ventricle at an end of a selected phase without further user intervention, wherein the generated volume excludes a plurality of papillary muscles.

Devito describes an apparatus for automatically identifying a long axis (12) of a left ventricle of a patient's heart (4) from SPECT data acquired during a nuclear medicine study. The apparatus includes a computer (8) for automatically reconstructing and automatically selecting, from the SPECT data, a single slice of the left ventricle, wherein the single slice is assumed to be a representative transverse slice of the left ventricle. Computer (8) automatically defines a reorientation axis that passes through a center of the single slice and is intersected by long axis (12) of the left ventricle. Computer (8) automatically reconstructs, from the SPECT data and along the reorientation axis, a sagittal slice of the left ventricle. Computer (8) also automatically defines an axis which passes through a center of the sagittal slice, and such a determined axis is long axis (12) of the left ventricle. Notably, Devito does not describe nor suggest generating an endocardial volume of a left ventricle at an end of a selected phase without further user intervention, wherein the generated volume excludes a plurality of papillary muscles.

Claim 1 recites a method for generating views of a heart, the method including "scanning a patient's heart using an imaging scanner to generate a multi-phase axial cardiac dataset; transferring the multi-phase axial cardiac dataset to a computer; receiving a selection of a heart phase from a user at the computer, said selection comprising at least one of a systole phase and a diastole phase; segmenting a left cavity volume image of the heart from the multi-phase axial cardiac dataset; calculating an axis of inertia of the segmented left cavity volume image; automatically generating, based on the calculated axis of inertia, at least one of a long axis orientation image and a short axis orientation image of the heart; and generating an endocardial volume of a left ventricle at an end of the selected phase without further user intervention, wherein the generated volume excludes a plurality of papillary muscles."

Neither Kanebako nor Devito, considered alone or in combination, describes or suggests a method as is recited in Claim 1. More specifically, neither Kanebako nor Devito, considered alone or in combination, describes or suggests generating an endocardial volume of a left ventricle at an end of a selected phase without further user intervention, wherein the generated volume excludes a plurality of papillary muscles. Rather, in contrast to the present invention, Kanebako describes a method of establishing a long axis and then, based on the

long axis, outlining the left ventricle of the heart, and Devito describes a method of calculating the long axis from an un-segmented image of the left ventricle. Accordingly, Applicants submit that Claim 1 is patentable over Kanebako in view of Devito.

Claim 7 has been canceled. Claims 4-6, 8-11, 21, and 22 depend from independent Claim 1. When the recitations of Claims 4-6, 8-11, 21, and 22 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 4-6, 8-11, 21, and 22 likewise are patentable over Kanebako in view of Devito.

Claim 13 recites a medical imaging apparatus for generating views of a heart along anatomically useful planes, the medical imaging apparatus including "an imaging system comprising: a detector array; at least one radiation source; a computer coupled to said detector array; and a workstation coupled to said computer, said workstation configured to: receive a multi-phase axial cardiac dataset from said computer; receive a selection of a heart phase from a user; segment a left cavity volume image of the heart from said multi-phase axial cardiac dataset; calculate an axis of inertia of said segmented left cavity volume image; and automatically generate, based on said calculated axis of inertia, at least one of a long axis orientation image and a short axis orientation image of the heart; and generate an endocardial volume of a left ventricle at an end of the selected phase without further user intervention, wherein the generated volume excludes a plurality of papillary muscles."

Neither Kanebako nor Devito, considered alone or in combination, describes or suggests a medical imaging apparatus having a workstation configured as is recited in Claim 13. More specifically, neither Kanebako nor Devito, considered alone or in combination, describes or suggests generating an endocardial volume of a left ventricle at an end of a selected phase without further user intervention, wherein the generated volume excludes a plurality of papillary muscles. Rather, in contrast to the present invention, Kanebako describes a method of establishing a long axis and then, based on the long axis, outlining the left ventricle of the heart, and Devito describes a method of calculating the long axis from an un-segmented image of the left ventricle. Accordingly, Applicants submit that Claim 13 is patentable over Kanebako in view of Devito.

Claims 14-17 and 23 depend from independent Claim 13. When the recitations of Claims 14-17 and 23 are considered in combination with the recitations of Claim 13,

Applicants submit that Claims 14-17 and 23 are likewise patentable over Kanebako in view of Devito.

Claim 19 recites a combination including "a computer; and a computer readable medium encoded with a program executable by the computer for generating views of a heart along anatomically useful planes, said program configured to instruct the computer to: receive a multi-phase axial cardiac dataset of the heart; receive a selection of a phase; segment a left cavity volume image of the heart from said multi-phase axial cardiac dataset; calculate an axis of inertia of said segmented left cavity volume image; automatically generate, based on said calculated axis of inertia, at least one of a long axis orientation and a short axis orientation image of the heart; generate an endocardial volume of a left ventricle at an end systole phase without further input; generate an endocardial volume of the left ventricle at an end diastole phase without further input; provide the generated volumes to a user for at least one of a verification and an edition of a myocardial contour for the volumes, wherein the generated volumes exclude a plurality of papillary muscles; and receive at least one of an indication of verification by the user and an edit from the user."

Neither Kanebako nor Devito, considered alone or in combination, describes or suggests a combination as is recited in Claim 19. More specifically, neither Kanebako nor Devito, considered alone or in combination, describes or suggests generating an endocardial volume of a left ventricle at an end of a selected phase without further user intervention, wherein the generated volume excludes a plurality of papillary muscles. Rather, in contrast to the present invention, Kanebako describes a method of establishing a long axis and then, based on the long axis, outlining the left ventricle of the heart, and Devito describes a method of calculating the long axis from an un-segmented image of the left ventricle. Accordingly, Applicants submit that Claim 19 is patentable over Kanebako in view of Devito.

Claim 24 depends from independent Claim 19. When the recitations of Claim 24 are considered in combination with the recitations of Claim 19, Applicants submit that Claim 24 likewise is patentable over Kanebako in view of Devito.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 1, 4-8, 10, 11, 13-17, 19, and 21-24 be withdrawn.

The rejection of Claims 1 and 6-9 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,435,310 to Sheehan et al. (hereinafter referred to as "Sheehan) in view of Devito is respectfully traversed.

Devito is described above. Sheehan describes a cardiac imaging and model processing system (30) having a CPU (32), an image processor (40), and an imaging device (42). Imaging device (42) can be used to scan a patient's heart (44), such as the left ventricle (46) of heart (44), and imaging device (42) produces a plurality of images along planes (54a-54f). Each image plane represents a cross-sectional scan of left ventricle (46), and left ventricle (46) includes an outer surface (62), an inner surface (64), and an aorta (68). The images showing an end diastole and/or an end systole are selected and the endocardial and epicardial borders of the left ventricle are manually traced by an operator or determined by software running on CPU (32) for each image. The data obtained by tracing the images is used to construct a model having an epicardial surface and an endocardial surface at end diastole and/or at end systole, for use in determining wall thickening. In addition, a model of the endocardial surface at end diastole and end systole, representing the location of the endocardial surface at the two extreme chamber volume conditions during a cardiac cycle is created using the data developed for each image plane at the end diastole and end systole times during the cardiac cycle. Moreover, Sheehan describes utilizing the papillary muscles as landmarks to facilitate determining cardiac wall thickness and motion. (Column 7, Lines 24-30; Column 16, Lines 29-37). Notably, Sheehan does not describe nor suggest generating an endocardial volume of a left ventricle at an end of a selected phase without further user intervention, wherein the generated volume excludes a plurality of papillary muscles.

Claim 1 recites a method for generating views of a heart, the method including "scanning a patient's heart using an imaging scanner to generate a multi-phase axial cardiac dataset; transferring the multi-phase axial cardiac dataset to a computer; receiving a selection of a heart phase from a user at the computer, said selection comprising at least one of a systole phase and a diastole phase; segmenting a left cavity volume image of the heart from the multi-phase axial cardiac dataset; calculating an axis of inertia of the segmented left cavity volume image; automatically generating, based on the calculated axis of inertia, at least one of a long axis orientation image and a short axis orientation image of the heart; and generating an endocardial volume of a left ventricle at an end of the selected phase without

further user intervention, wherein the generated volume excludes a plurality of papillary muscles."

Neither Sheehan nor Devito, considered alone or in combination, describes or suggests a method for generating views of a heart as is recited in Claim 1. More specifically, neither Sheehan nor Devito, considered alone or in combination, describes or suggests generating an endocardial volume of a left ventricle at an end of a selected phase without further user intervention, wherein the generated volume excludes a plurality of papillary muscles. Rather, in contrast to the present invention, Sheehan describes utilizing the papillary muscles as landmarks to facilitate determining cardiac wall thickness and motion, and Devito describes a method of calculating the long axis from an un-segmented image of the left ventricle. Accordingly, Applicants submit that Claim 1 is patentable over Sheehan in view of Devito.

Claim 7 has been canceled. Claims 6, 8, and 9 depend from independent Claim 1. When the recitations of Claims 6, 8, and 9 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 6, 8, and 9 likewise are patentable over Sheehan in view of Devito.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 1 and 6-9 be withdrawn.

In view of the foregoing remarks, all of the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully submitted,

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